SHELF STABLE MEATS

Dr. Rody Hawkins
RDI Foods, LLC
Alternate Title:

It Smells Just Like When We Put It In There!
Convenient Stores
Warehouse Clubs
Pallet Display
Supermarkets
Shelf Stable Meat Snacks

- Jerky – Beef, Turkey, etc.
- Beef Steak – Kippered Beef, Nuggets
- Dry Sausage – Snack Stick, Beef Stick
- Semi-Dry Sausage – Fermented, Acidified
- Pickled Sausage – Vinegar, Salt
Types of Beef Jerky

- **Natural Style**
  From a single piece of beef (meat)

- **Chunked and Formed**
  From chunks which are molded

- **Ground and Formed**
  Ground meat formed into strips
Types of Sausage Sticks

- **Beef (Meat) Stick** – Dry Sausage
  Non-fermented, just dried

- **Semi-dry Sausage** – Summer Sausage, Salami Stick
  Fermented, some drying

- **Dry Sausage** – Slim Jim, Snack Stick
  Fermented and dried
Kippered Beef, Steak, Nugget

- A cured dry product similar to beef jerky but not as dry
- Water controlled with high salt or sugar
- MPR higher than beef jerky
Hurdle Technology
Hurdle Technologies

- Lothar Leistner
  - Food Designs by Hurdle Technology and HACCP, 1994
  - New Methods of Food Preservation, 1995
Control Factors Associated with Long Term Shelf Stability

- Water Activity
- pH
- Atmosphere
- Antimicrobial Ingredients
- Light (Radiation, Redox Potential)
- Ingredient Composition (Interaction)
- Processing Procedures
- Initial Microbial Load
Two Prominent Advancements

• Daishiro Fujishima
  ➢ Develop the Oxygen Absorber in 1973 called “Keplon”
  ➢ Designed for Fresh Fruits and Vegetables
  ➢ Mitsubishi version invented in 1977 - Ageless

• Steve Klawiter
Brands of Oxygen Absorbers

- Ageless
- Multisorb
- Keplon
- Best Kept
- Fresh Pak
- O-Busters
- Oxy-Free
Two Prominent Advancements

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- **Steve Klawiter**
  - Designed Clear, High Barrier, Multilayer Meat Snack Films
  - Balanced MVTR & $O_2$ TR between Forming & Non-Forming Films (this required different structures)
  - Made these Films Available to Meat Snacks - 1990
High Barrier Films

• Jerky Film
  ➢ Slowed MVTR  >0.19 g /100in² / day
  ➢ Slowed OTR  >0.13 g /100in² / day
  ➢ Early Resins:  PVDC, PE, EVOH, Surlyn, Nylon

• Stick Film
  ➢ Slowed MVTR  >1.0 g /100in² / day
  ➢ Slowed OTR  >0.3 g /100in² / day
  ➢ Forming Resins:  PE, Nylon, EVOH, Surlyn
  ➢ Non-Forming Resins:  PET, PVDC, ADH, PE, Surlyn
Pallet Display
Packaging Types

- Gas-flushed
- Vacuumed
- Oxygen scavenger
Gas-Flushed Packaging

- Residual oxygen present
- Quick and inexpensive
- Visually appealing packaging
- No way to tell if gas is present (oxygen tabs)
Vacuumed Packaging

- Tight packaging
- Some residual oxygen in voids
- Easy to identify leaking packages
- Package is distorted
Oxygen Scavenger Package

- Requires an oxygen scavenger in contact with jerky
- Correct size removes all oxygen
- Increases shelf life due to residual effect
- Visually appealing packaging
- Slightly more expensive
Hurdle Technologies

- Lothar Leistner
  - Food Designs by Hurdle Technology and HACCP, 1994
  - New Methods of Food Preservation, 1995

- GoodMark Foods R&D
  - Conducted first challenge study with Silliker to prove “hurdle technology” works with Beef ‘N Cheese - 1990
  - Introduced high barrier films with oxygen absorber in beef jerky – 1990 to 1991
  - Began CRADA with U.S. Army to develop long term shelf life, intermediate moisture meat products - 1993
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Moisture – Protein Ratio

- **Beef Jerky**: 0.75 : 1
- **Dry Sausage**: 1.9 : 1
  - Dry Salami, Snack Stick, Beef Stick
- **Kippered Beef**: 2.03 : 1
- **Semi-Dry Sausage**: 2.3 : 1
  - Genoa Salami, Sicilian Salami
- **Shelf Stable Sausage (pH ≤ 5.0)**: 3.1 : 1
  - Summer Sausage, General Sausages
Water Activity

• Development of Quick Action Meter
  ➢ Days → Hours → Minutes

• More accurate measurement of available moisture

• Could combine moisture measurement with other factors, especially pH
Characteristics of Growth for Nine Pathogens Associated with Meat and Poultry Products

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Temperature of growth</th>
<th>pH</th>
<th>Minimum Aw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacillus cereus</td>
<td>10–48 °C</td>
<td>4.9–9.3</td>
<td>0.95</td>
</tr>
<tr>
<td>Campylobacter jejuni</td>
<td>30–47 °C</td>
<td>6.5–7.5</td>
<td></td>
</tr>
<tr>
<td>Clostridium botulinum (Types A,B,E)</td>
<td>3.3–46 °C</td>
<td>&gt;4.6</td>
<td>0.94</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>15–50 °C</td>
<td>5.5–8.0</td>
<td>0.95</td>
</tr>
<tr>
<td>Escherichia coli O157:H7</td>
<td>10–42 °C</td>
<td>4.5–9.0</td>
<td>0.95</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>2.5–44 °C</td>
<td>5.2–9.6</td>
<td>0.92</td>
</tr>
<tr>
<td>Salmonella</td>
<td>5–46 °C</td>
<td>4–9</td>
<td>0.94</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>6.5–46 °C</td>
<td>5.2–9</td>
<td>0.86</td>
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<tr>
<td>Yersinis enterocolitica</td>
<td>2–45 °C</td>
<td>4.6–9.6</td>
<td></td>
</tr>
</tbody>
</table>

USDA Rules and Regulations Appendix D—Hazards and Preventive Measures Guide
Consumer Claims

- High in Protein
- Low in Carbohydrates
- Low in Fat
- Portable – can eat anywhere
- Long shelf life to endure ambient distribution networks
FAT FREE

But we do charge for the other ingredients.

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